

Confined Space Entry: There's Always Room To Do It Right!



TELNPS Participant Guide DAY 1

Prepared by
NPS Risk Management Division

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How to Interact with the Instructor

We encourage you to ask questions and share your comments with the instructors throughout this TELNPS course.

If you were physically in the classroom with the instructor, you would raise your hand to let him know you had a question or comment. Then you would wait for the instructor to recognize you and ask for your question. We are all familiar with that “protocol” for asking questions or making comments.

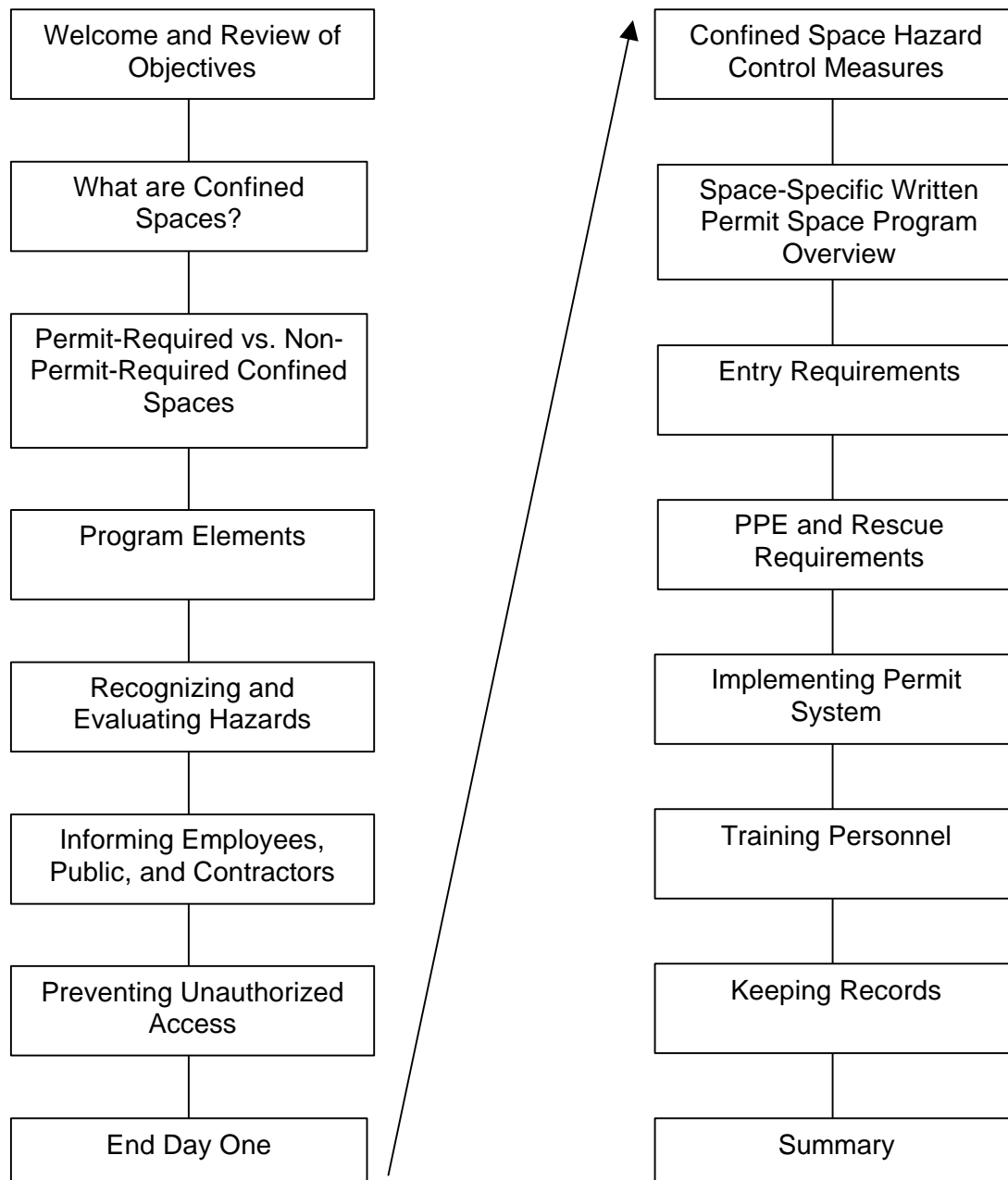
With TELNPS courses there is also a “protocol” to follow to ensure you can easily ask questions and others can participate as well. It may seem a little strange at first asking a question of a TV monitor. Remember, it is the instructor you are interacting with and not the monitor. As you ask more questions and participate in more TELNPS courses, you will soon be focusing only on the content of your question and not the equipment you are using to ask it.

As part of the TEL station equipment at your location, there are several push to talk microphones. Depending on the number of students at your location, you may have one directly in front of you or you may be sharing one with other students at your table.

*When you have a question, press the push to talk button and say,
“Excuse me [instructor’s first name], this is [your first name]
at [your location]. I have a question (or I have a comment).”
Then release the push to talk button. This is important.
Until you release the button, you will not be able to hear the instructor.*

The instructor will acknowledge you and then ask for your question or comment. Stating your name and location not only helps the instructor, but also helps other students who are participating at different locations to get to know their classmates.

Confined Spaces: There's Always Room To Do It Right! Course Map



Course Objectives**Notes**

At the conclusion of this course, you should be able to:

1. Identify a confined space.
2. Identify a permit-required confined space.
3. Recognize confined space hazards.
4. Conduct a confined space evaluation.
5. Know the requirements and method for informing employees and contractors of the existence of confined spaces.
6. Describe atmospheric test equipment and how it is used.
7. Describe methods for controlling confined space hazards.
8. Describe ways to effectively employ ventilation equipment.
9. Discuss the requirements for implementing a permit system, including the contents of a permit system, when a hot work permit is required, and how it is prepared.
10. Explain the requirements for training authorized entrants, attendants, entry supervisors, and rescuers.
11. Describe non-entry rescue equipment and its use.
12. List the required elements of a permit-required confined space entry program.
13. Prepare written permit space entry procedures for permit spaces in his or her park.
14. List record keeping requirements.

**What are some confined spaces at your park or location?**

Take 2-3 minutes and see how many confined spaces at your park you can think of. Write down the list below and be prepared to share your list with your classmates.

What Are Confined Spaces?

Confined space

A space that:

- 1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- 2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and
- 3) Is not designed for continuous employee occupancy.

Why should we be concerned about confined space safety?

NIOSH Study

20,000 accidents

Of these 276 were associated with confined spaces.

The 276 confined space accidents resulted in 234 deaths and 193 injuries.

Of the 234 deaths, 60% were the rescuer.

50% of the accidents involved 1 or more supervisors.

What are the most common reasons that confined space accidents occur?

1. workers fail to recognize confined spaces and the associated dangers
2. workers are too trusting of their senses
3. workers underestimate the danger
4. workers become complacent
5. workers attempt to rescue their colleagues.

Permit-required confined space (permit space)

A confined space that has one or more of the following characteristics:

- 1) Contains or has a potential to contain a hazardous atmosphere;
- 2) Contains a material that has the potential for engulfing an entrant;
- 3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- 4) Contains any other recognized serious safety or health hazard.

Non-permit confined space:

A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

What Are Confined Spaces? (cont.)**Notes****Parade of Spaces**

As the instructor reviews several common confined spaces, determine whether you think the space should be considered a permit required confined space or a non-permit required confined space.

**To Permit or Not To Permit – That Is The Question!**

Refer back to page 3 and review the list of confined spaces that you came up for your park or location. Write each of the confined spaces in the table below based on what you have learned about Permit Spaces and Non-Permit Spaces

Permit Spaces	
Non-Permit Spaces	
Not Sure	

Permit-Required Confined Space Program**Notes**

The following references provide requirements and guidance for a Permit-Required Confined Space Program:

29 CFR 1910.146

The Program includes the following elements:

1. Identify Permit-Required Confined Spaces.
2. Inform Employees and Post Signs.
3. Prevent Unauthorized Access.
4. Inform Contractors.
5. Prepare a Written Permit Space Program.
6. Implement a Permit System.
7. Ensure Emergency and Rescue Service Availability.
8. Train Personnel.
9. Keep Records.

Identify Permit-Required Confined Spaces **Conducting an Inventory**

Notes

Appendix B has a sample worksheet that could be used for evaluating a confined space.

Appendix C has examples of written permit space programs.



Inventorying Your Permit-Required Confined Spaces

Select one of the permit-required confined spaces that you identified on page 6 and complete the following portions of the confined space evaluation worksheet for that space.

Confined Space Identification: _____
(Park Alpha Code plus 4 digit number 0001, 0002, etc.)

Type of Confined Space: _____
(Abandoned Well, Electrical Vault, Fuel Tank, Mobile Fuel Tank, Sewer Lift Station, Sewer Manhole, Silo or hopper, Storm Water Manhole, Telephone Vault, Valve Pit, Water Tank, etc.)

Location: _____
(Be specific i.e. Maintenance Annex Facility; North Administration Bldg, etc.)

Classification: ☐ Permit-Required ☐ Non-Permit Required

Reasons for Entry:
(Cleaning, repair, routine maintenance, etc.)

Recognizing and Evaluating Hazards in Permit-Required Confined Spaces

Notes

There are two categories of hazards presented by confined spaces:

- Atmospheric Hazards
- Physical Hazards

Atmospheric hazards can be broken down into the following categories:

- Oxygen Deficiency and Enrichment
- Toxic Atmospheres
- Irritants
- Explosive Atmospheres

The first rule to remember is that we test for O₂, toxicity, and flammability prior to each entry into a confined space.

O₂ Deficiency

Like the miners who carried with them a canary in a cage, we carry an *atmospheric monitor*. This oxygen sensor is also small and lightweight, but it has the advantage of providing a direct, immediate, and continuous reading, and of activating an alarm when the Oxygen level drops below 19.5%.

Toxic Gas Instruments

1. Colormetric Indicator Tubes
 - Draeger
 - Sensidyne
 - MSA
2. Direct Reading Instruments
 - CO
 - H₂S
 - SO₂
 - NO/NO₂

Combustible Gas Indicator

1. Gas Tec
2. Neutronics—Mini Gas

Flammability must be less than 10% of LEL.

Multigas Meter

All of the above can be measured using a Multigas Meter—oxygen deficiency, carbon monoxide, hydrogen sulfide, and explosive limits.

Recognizing and Evaluating Hazards in Permit-Required Confined Spaces

Notes

The most common *physical hazards* that workers are exposed to within confined spaces are

- Engulfment
- Falls
- Burns
- Electrocution
- Converging Walls



**What are the hazards associated with your confined space?
What is the required testing?**

Take a few moments and list the hazards associated with the permit-required confined space you chose on page 7. Also note the type of testing required and the frequency of the testing that should be done. Discuss questions with your site partners, and in a few minutes we'll field as a whole group any questions you still have about required recognizing and evaluating hazards in permit-required confined spaces.

Informing Employees

Notes

After evaluating the work space, the next required step is to inform the employee of the

- Existence of the permit-required confined space
- Location of the permit-required confined space
- Dangers associated with the specific permit space.

Part of meeting these requirements is to post appropriate danger signs at the entrance to each space. Signs should clearly display the words:

“DANGER, PERMIT—REQUIRED CONFINED SPACE, DO NOT ENTER.”

If spaces cannot be posted, it is essential to inform employees of their existence and location.

Informing Contractors

Oftentimes, contractors or other employers will be working in permit spaces, and it is essential for their safety to inform them of hazards and to coordinate multi-employer work so that they can protect themselves and their employees.

The park will ensure that they are prepared to enter permit-required confined spaces in accordance with 29 CFR 1910.146 and applicable State regulations prior to any entry by taking the following steps:

- a. Inform the contractor that the workplace contains permit-required confined spaces and that entry must be in compliance with 29 CFR 1910.146
- b. Inform the contractor of the identified hazards associated with the space.
- c. Inform the contractor of any hazard controls implemented by the park as well as any appropriate precautions.
- d. Debrief the contractor after entry operations are finished to discuss any problems or hazards encountered during the entry.
- e. Coordinate entry operation of multiple employers working simultaneously.

Each contractor who is retained to perform permit space entry operations will:

- a. Comply with all permit space requirements outlined in 29 CFR 1910.146.
- b. Obtain any available information regarding space entry hazards and operations from the Park.
- c. Coordinate entry operations with the Park and contracted personnel when they will be working simultaneously in or near a permit space.
- d. Inform the Park of any hazards or problems confronted or created during entry activities.

Provide a copy of their site-specific permit-required confined space entry plans to the Contracting officer.

Prevent Unauthorized Access

Notes

We need to take effective measures to secure the permit space to prevent unauthorized entry.

Two aspects of this are

1. Securing the unattended space with locks and barricades.
2. Securing the work space during entry from the presence of unauthorized people.
This is the responsibility of the *attendant*.



How Would You Prevent Access?

Think about the permit-required confined space you have chosen. What measures would you take to prevent access to that space?



DAY 1 – Assignment (To Be Completed Before Class on Day 2)

Identify 12 confined spaces at your park or location. Complete the confined space evaluation worksheet (Appendix B) for 6 of these spaces. Go online to www.govlearning.net/nps and complete the confined space survey web form for at least 4 of the 6 spaces.

Appendix A: Helpful Resources

NPS Risk Management

<http://www.nps.gov/riskmgmt/>

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Appendix B Confined Space Evaluation Worksheet

This form may be used to document initial evaluations of confined spaces and to develop space-specific procedures and requirements.

Confined Space Identification: _____

(Park Alpha Code plus 4 digit number 0001, 0002, etc.)

Type of Confined Space: _____

(Abandoned Well, Electrical Vault, Fuel Tank, Mobile Fuel Tank, Sewer Lift Station, Sewer Manhole, Silo or hopper, Storm Water Manhole, Telephone Vault, Valve Pit, Water Tank, etc.)

Location: _____

(Be specific i.e. Maintenance Annex Facility; North Administration Bldg, etc.)

Classification: ☐ Permit-Required ☐ Non-Permit Required

Reasons for Entry: 1. _____

(Cleaning, repair,
routine maintenance, etc.) 2. _____

3. _____

Hazards: 1. _____

2. _____

3. _____

4. _____

5. _____

(For example, atmospheric hazards such as oxygen deficiency, toxic gases, or flammable gases; engulfing potential; falls; stored energy, etc.)

Appendix B Confined Space Evaluation Worksheet (page 2)

Surveillance and Inspection Requirements: (Include testing required and frequency)

Ventilation Requirements:

Special Entry Requirements:

Personal Protective Equipment Requirements:

Rescue Equipment and Procedures:

Appendix C Written Permit Space Program Examples

Example 1: Written Permit Space Program for Sewer Manholes

Space:

COSP 001 Sewer Manhole, Maintenance Annex Facility
COSP 002 Sewer Manhole, Visitor's Center

Classification: Permit Required Confined Space (Alternate entry methods may be used if criteria are met for Sewer Manhole)

Reason for Entry: Cleaning and Maintenance

Hazards:

- a. Oxygen deficiency. (O₂ deficient atmospheres were found in space COSP 001 (18%) during evaluation)
- b. Flammable atmosphere. (methane). (Flammable atmosphere was detected in space COSP 002 (10% LEL)
- c. Toxic Gas. (Hydrogen sulfide)
- d. Biological Hazards. (communicable disease agents)
- e. Restricted movement
- f. Drowning (standing water)
- g. Falls (space COSP 002, approximately 20 feet)
- h. Landfill leachates (space COSP is down gradient from landfill)
- i. Ladders in disrepair or poor design (spaces COSP 001 and COSP 002)

Surveillance and Inspection Requirements

- a. Test atmosphere directly beneath cover for percent O₂ and combustible gas (%LEL) prior to opening covers.
- b. Test atmosphere with calibrated direct reading meter or instrument for:
 - 1) Percent oxygen content
 - 2) Percent of the lower explosive limit
 - 3) Hydrogen sulfide concentration (ppm, H₂S)
- c. Inspect for sludge or other foreign material at the bottom or sides of the space that might give off flammable or toxic substances when disturbed by work activity. Floor of space must be visible.
- d. Monitor atmosphere continuously in the vicinity of workers in the space.
- e. All pumps and lines that may reasonably cause contaminants to flow into the space shall be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of

dangerous air contamination or engulfment. Laterals to sewers or storm drains may not require blocking if experience or knowledge of use indicates there is not a reasonable potential for contamination of air or engulfment in the occupied sewer.

Entry

- a. If no atmospheric hazards are present and visual inspections reveal no potential hazard, the space may be entered using alternate procedures as described
- b. If public has access, the area will be demarcated and a barrier erected to keep pedestrians from falling and to keep objects from falling into the space and injuring the entrant.
- c. All electrical power sources will be isolated.
- d. Do not use Freon for leak detection.
- e. Use only explosion-proof electrical equipment and lighting. All electrical switching connections and disconnections must be made outside the space and away from the opening.
- f. If atmospheric hazards are present, the space must be ventilated. Where possible, open additional manholes to increase air circulation. Use mechanical ventilation to augment natural circulation if needed. After ventilation, repeat testing and follow Permit required entry procedures.

Personal Protection and Protective Equipment

- a. Protective clothing to prevent contact with raw sewage residues.
- b. Coveralls
- c. Rubber or PVC boot and gloves. Ensure that boot soles and glove contact surfaces provide good traction and grip so that slips and falls are prevented.
- d. Hard hat
- e. Ensure that individuals follow good hygiene practices and wash after entry is complete.

Rescue

- a. Provide and secure ladder for entry and egress. Ladders fixed in place must be clear and in good repair.
- b. Safety harness and life line required
- c. Tripod and winch to assist a non-entry rescue required.

Appendix C Written Permit Space Program Examples

Example 2: Written Permit Space Program for Sewage Lift Station Dry Wells

Space:

COSP 003 Sewage lift station dry well, North Cape site
COSP 004 Sewage lift station dry well, South Beach

Classification: Permit-required confined space, Alternate entry methods may be used when criteria have been met.

Reasons for entry:

- a. Space COSP 003 is abandoned and secured. No entry is permitted.
- b. Space COSP 004—Cleaning, maintenance, meter reading and logging.

Hazards:

- a. Oxygen deficiency
- b. Flammable atmosphere. (methane)
- c. Toxic Gas. (CO)
- d. Falls

Surveillance and Inspection:

- a. Test atmosphere with calibrated direct reading meter or instrument for
 - 1) Percent oxygen
 - 2) Percent of lower explosive limit
 - 3) Carbon monoxide
- b. Ensure that mechanical ventilation systems in dry well has been turned on and operating for at least 5 minutes prior to entry.

Entry:

- a. If no atmospheric hazards are present and visual inspection reveals no potential hazard, the space may be entered using alternate entry procedures.
- b. Use integral restraint systems installed in dry well. Attach lifeline prior to stepping onto platform.
- c. In locations where general public is not restricted, area will be demarcated and barrier erected to keep pedestrians from falling and to keep objects from falling into the space and injuring the entrant.

- d. Do not use Freon for leak detection.

Personal Protection and Protective Equipment. Ensure that soles and glove contact surfaces provide good traction and grip so that slips and falls are prevented.

Appendix C Written Permit Space Program Examples

Example 3: Written Permit Space Program for Steam Vaults

Spaces:

COSP 005, Steam Vault, North Administration Building
COSP 006, Steam Vault, East Administration Building

Classification: Permit-required confined space

Reasons for entry:

- a. Annual inspection
- b. Maintenance. Steam distribution system maintenance may include welding and cutting with acetylene torch, valve packing, pipe repair.

Hazards:

- a. Oxygen deficient atmosphere
- b. Combustible gases or vapors (organic hydrocarbons, fuel vapors from adjacent fueling station in space COSP 005).
- c. Toxic gases or vapors.
- d. Introduced hazard during welding and cutting (O₂ enrichment, acetylene, smoke, welding fumes).
- e. Hot surfaces
- f. Live steam
- g. Combustible solids (litter in space COSP 005)
- h. Asbestos pipe insulation (presumed asbestos material in space COSP05)
- i. Ladders in disrepair.

Surveillance and Inspection:

- a. Test atmosphere with calibrated direct reading meter for:
 - 1) Oxygen
 - 2) Flammable atmosphere
 - 3) Toxic gases and vapors appropriate to the task

Note: Meters may be sensitive to high humidity within steam vaults resulting in high reading for some instruments.
- b. Drop tests must performed. Test all locations and depths within the vault.
- c. Inspect for sludge or other foreign material on the bottoms and sides of the space. These may give off flammable or toxic substances if disturbed by walking or heated by hot work.
- d. Isolate steam prior to entry.

- e. Continuously monitor atmosphere for oxygen content, LEL and toxic during hot work.

Ventilation:

- a. Provide continuous forced air ventilation to entrants during entry.
- b. Provide local exhaust ventilation during hot work to remove smoke, gases and fumes produced.

Entry:

- a. Area will be demarcated and a barrier erected to keep pedestrians from falling and to keep objects from falling into the space and injuring the entrant.
- b. Remove combustible materials such as litter and clean surfaces of oils or other combustible substances prior to hot work.
- c. Compressed gas cylinders must not be taken into spaces. Inspect hoses, connections and torches of gas welding and cutting equipment prior to use.

Personal Protective equipment:

- a. Hard hat
- b. Coveralls
- c. Steel toed rubber boots
- d. Safety goggles or glasses
- e. Heat protective gloves when appropriate

Rescue:

- a. Provide ladder or other means to ensure easy and safe entry and egress.
- b. Provide and use safety harness and lifeline
- c. Provide tripod and winch to assist in non-entry rescue.

Appendix C Written Permit Space Program Examples

Example 4: Written Permit Space Programs for Fuel tanks

Spaces

COSP 007, Used Oil Tank, 3500 gal, North Hill
COSP 008, Fuel Oil Tank, Maintenance Facility
COSP 009, Gasoline Tank, Maintenance Yard

Classification: Permit-required confined space.

Reasons for Entry: Cleaning and sludge removal.

Hazards:

- a. Oxygen deficient atmosphere (oxidation processes)
- b. Flammable vapors
- c. Toxic vapors (organic hydrocarbons)
- d. Benzene (COSP 009)
- e. Dermal exposure to hydrocarbons

Surveillance and Inspections:

- a. Test atmosphere with calibrated, direct reading, intrinsically safe meter for:
 - 1) Oxygen content
 - 2) Percent of LEL
 - 3) Toxic vapors (petroleum hydrocarbons in spaces COSP 007 and 008) (benzene in COSP 009)
- b. Test at all locations and depths within the tank. Pay particular attention to areas where vapors may pocket such as sumps and baffled areas. Test through openings with a drop tube.
- c. Continuously monitor atmosphere for oxygen content and percent LEL, and for toxic vapors every 15 minutes.
- d. Monitor for % LEL (and benzene for space COSP 009) in the area surrounding the tank during purging.

Ventilation:

- a. Remove all ignition sources prior to purging.
- b. Purge tank and maintain forced ventilation during entry.
- c. Ensure ventilation equipment is properly bonded or grounded.
- d. Vent vapors well away from tank. Ensure vapors do not collect in low spots.

- e. Do not use steam to purge tank.

Entry

- a. Post the following signs in the vicinity of the tank:
 - 1) NO SMOKING
 - 2) HARD HAT AREA
 - 3) NO OPEN FLAMES OR SPARK PRODUCING EQUIPMENT BEYOND THIS POINT
- b. Ensure all portable hand tools are explosion proof and designed for hazardous atmospheres.
- c. Ensure all portable electric equipment capable of generating static electricity is properly bonded or grounded if tank is non-metallic.
- d. Have at least 2 fire extinguishers, B/C rated, within easy access.
- e. When possible pass through portals near ground level (within 3 feet) rather than portals at the top of the tank.

Personal Protective Equipment:

- a. Hard hat
- b. Chemical protective coveralls
- c. Chemical protective boots
- d. Safety goggles
- e. Chemical protective gloves

Rescue:

- a. Provide ladder or other means to ensure easy and safe entry and egress.
- b. Provide and use safety harness and lifeline.
- c. Provide tripod and winch to assist a non-entry rescue.